PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of:

Chandrika Varadachari

Application No.: 10/567,303

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For: A PROCESS FOR THE MANUFACTURE OF BIO-RELEASE IRON-MANGANESE FERTILIZER

Group: 1793

Examiner: Wayne A. Langel

DECLARATION UNDER 37 C.F.R. 1.132

Mail Stop Amendment

Commissioner for Patents

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Sir:

I, Chandrika Varadachari, declare under penalty of perjury that:

1. I reviewed claim 1 of the above-identified application and claim 1 recites:

A process for the preparation of water insoluble, bio-release iron-manganese polyphosphate fertilizer, the process consisting of

a) heating phosphoric acid at a temperature of at least 160°C with a mixture **consisting essentially of** (i) a source of iron oxide including one or more substance selected from the group

consisting of goethite and hematite, (ii) pyrolusite and (iii) one or more basic compound selected from the group consisting of magnesium oxide(s), magnesium carbonate, calcium oxide, sodium oxide, potassium oxide, calcium carbonate, sodium carbonate, and potassium carbonate for a time period ranging from 20 minutes to 2 hours to produce a liquid polyphosphate;

b) neutralizing the liquid polyphosphate **at a pH of 5 to 7.5**, wherein the neutralized liquid is characterized by solubility in 0.33M citric acid and 0.005M DTPA;

c) drying the neutralized liquid polyphosphate to obtain a solid; and

d) pulverizing the solid.

Bold, underline emphasis added.

2. I reviewed the August 12, 2009 office action pending in the above-identified application.

3. I reviewed the prior art reference U.S. patent No. 3,574,591, which was cited in the August 12, 2009 office action and over which claims 1 – 14 and 16 – 20 were rejected as obvious.

4. I conducted or had conducted under my supervision three additional experiments, A – C,. The procedures and results of the additional experiments are as follows.

5. **Experiment A**. Phosphoric acid containing 60 % P_2O_5 was taken in a glass beaker. To 145 g of the acid, 16 g of goethite (containing 62 % Fe), 7.86 g pyrolusite (containing 63 % Mn) and 8.2 g magnesia (containing 60.3 % Mg) was added and stirred. The colour of the mixture at this stage was dirty yellow. The beaker was then placed in a furnace set at **150°C**. After **2h 20 min (140 min)** of heating, the beaker was taken out of the furnace. At this stage the material was liquid suspension with unreacted particles.

   It was neutralised with ammonia to pH 5.6 whereupon it formed a suspension. A small portion of this suspension was tested for its solubility in 0.33M citric acid and 0.005 DTPA. It was mostly insoluble and produced a hazy solution with much residue. The suspension was dried in an oven at 80°C whereupon a solid was formed. This was also insoluble in 0.33M citric acid and 0.005 DTPA.

6. **Experiment B**. Phosphoric acid containing 60 % P_2O_5 was taken in a glass beaker. To 145 g of the acid, 16 g of goethite (containing 62 % Fe), 7.86 g pyrolusite (containing 63 % Mn) and 8.2 g magnesia (containing 60.3 % Mg) was added and stirred. The colour of the

mixture at this stage was dirty yellow. The beaker was then placed in a furnace set at **300°C**. Much frothing occured as the polymerisation proceeded. After **15 min** of heating, the beaker was taken out of the furnace. At this stage the material was a highly viscous black liquid with a purple tinge.

7. It was neutralised with ammonia to pH 5.6 whereupon it formed a suspension. A small portion of this suspension was tested for its solubility in 0.33M citric acid and 0.005 DTPA. It was mostly insoluble and produced a black residue. The suspension was dried in an oven at 80°C whereupon a solid was formed. This was also insoluble in 0.33M citric acid and 0.005 DTPA.

8. **Experiment C**: was conducted as described in Example 1 of application.

9. The data from Experiments A – C, as described in paragraphs 4 – 8 is presented in Table 1, below.

No	Temperature of heating	Time of heating	Physical state of reaction mixture before neutralization	Solubility in 0.33M citric acid and 0.005 DTPA	Physical state of reaction mixture after neutralization and drying	Solubility of neutralized product in 0.33M citric acid and 0.005 DTPA
A	150°C	2h 20min (140 min)	***Slightly viscous liquid with unreacted sediments***; green in colour	***Mostly insoluble***; Produces hazy solution with much residue	***Solid***	***Mostly insoluble***
B	300°C	15 min	***Highly viscous liquid***; black with purple tinge	***Mostly insoluble***; hazy solution with black residue	***Solid***	***Mostly insoluble***
C	200°C	45 min	***Viscous liquid***; Black in colour	***Soluble***; Clear yellow solution	***Solid***	***Soluble***

10. The above observations can be summarized as follows:

i. At 150°C, complete reaction does not occur even after 2h 20 min of heating. Unreacted solids remain and the product does not dissolve in citric acid and DTPA.

ii. At 300°C, after 30 min of heating a thick viscous material is formed which is over-polymerised and shows only slight solubility in citric acid and DTPA.

iii. Of these solids, only that produced from polyphosphate polymerised to an optimum level (with 45 min heating at 200°C) is soluble in citric acid and DTPA.

11. The above data show that appropriate neutralisation occurs only in the process of the present invention, and the product is dissolvable in citric acid and DTPA. As shown in example 2 of the above-identified application, this product has been shown to be a better micronutrient.

12. I have been warned that willful false statements and the like are punishable by fine or imprisonment, or both (18 U.S.C. 1001) and may jeopardize the validity of the application or any patent issuing thereon.

13. The foregoing is true and correct to the best of my knowledge, information and belief.

Date: 11 November 2009

Chandrika Varadachari

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